

REMARKS

Favorable reconsideration and allowance of the claims of the present application, as amended herein, are respectfully requested.

In the present Office Action, Claims 1-5, 10-16 and 18 stand rejected, under 35 U.S.C. §102(b), as allegedly anticipated by U.S. Patent No. 6, 492, 270 to Lou ("Lou"). Claims 6-9 and 17 stand rejected, under 35 U.S.C. §103(a), as alleged unpatentable by Lou. Claim 8 stands objected to because of minor informalities. New corrected drawings are also required because the drawings submitted with the specification were informal.

Before addressing the substantive grounds of rejection, applicants have amended Claim 1 to positively and clearly recite that the dielectric sidewall spacers are of a material selected from the group consisting of SiCH, SiCOH, SiC and SiO₂. Support for the amendment to Claim 1 is found in original Claim 4. In light of the amendment to Claim 1, Claim 4 has been canceled.

Applicants have also amended Claim 10 to positively and clearly recite that the mechanically rigid dielectric layer separates the upper metal wiring level from the lower metal wiring level. Support for this amendment is found in FIG. 13 of the present application. Specifically, FIG. 13 depicts the resultant structure of applicants' method, in which the mechanically rigid dielectric layer 35 is deposited atop the lower metal wiring level 31, separating the lower metal wiring level 31 from the subsequently deposited upper metal wiring level 45.

Dependent Claim 8 stands objected to for not reciting the term "Claim" before the number of the claim to which it is dependent. In response to the Examiner's comments, applicants have amended Claim 8 to recite the terms "of Claim" before the number of the

base claim to which the claim depends. In light of the amendment to Claim 8, applicants respectfully request that the objection to Claim 8 be withdrawn.

In response to the requirement to provide corrected drawings, applicants submit herewith formal drawings in compliance with the requirements set forth in 37 C.F.R. §1.84. Therefore, in light of formal drawings, applicants respectfully request that the requirement to submit corrected drawings has been met.

Turning to the rejection of Claims 1-5, 10-16, and 18 under 35 U.S.C. §102(b), it is axiomatic that anticipation under §102 requires the prior art reference to disclose every element to which it is applied. *In re King*, 801 F.2d 1324, 1326, 231 USPQ 36, 138 (Fed Cir, 1986). Thus, there must be no differences between the subject matter of the claim and the disclosure of the prior art reference. Stated another way, the reference must contain within its four corners adequate direction to practice the invention as claimed. The corollary of the rule is equally applicable: absence from the applied reference of any claimed element negates anticipation. *Kloster Speedsteel AB v. Crucible Inc.*, 793 F.2d 1565, 1571, 230 USPQ 81, 84 (Fed. Cir. 1986).

Referring to the §102 rejection of Claims 1-5, applicants submit that Lou fails to anticipate applicants' claimed invention, since Lou fails to disclose each and every aspect of the embodiment of applicants' method recited in amended Claim 1. Applicants' claimed method includes the steps of providing a lower metal wiring layer having first metal lines located within a lower low-k dielectric; depositing an upper low-k dielectric atop the lower metal wiring layer; etching at least one portion of the upper low-k dielectric to provide at least one via to the first metal lines; forming rigid dielectric sidewall spacers in said at least one via of said upper low-k dielectric, *said rigid*

dielectric sidewall spacers are of a material selected from the group consisting of SiCH, SiCOH, SiC and SiO₂; and forming second metal lines in said at least one portion of said upper low-k dielectric, as recited in amended Claim 1. More specifically, Lou fails to disclose a method that comprises forming *rigid dielectric sidewall spacers of a material selected from the group consisting of SiCH, SiCOH, SiC and SiO₂*.

Lou discloses a method for providing high aspect ratio damascene structures using a combination of electroless plating and physical vapor deposition of copper. Referring to FIG. 2e of the Lou disclosure, Lou discloses that prior to the deposition of copper spacers 300 are formed abutting the sidewalls of the vias and trenches of a dielectric material. The spacers 300 disclosed in Lou are composed of SiN. In accordance with the method disclosed in Lou, and in order to provide copper interconnects through high aspect ratio vias, the copper is deposited using electroless plating. Depositing copper within the vias by electroless plating requires activation of the surfaces of the SiN spacers. Referring to Column 7, line 2, of the Lou disclosure, a “key aspect” to the deposition of copper using the electroless plating method is that the surfaces of the SiN spacers within the via 280 opening are activated by a chemical solution comprising HF, CuSO₄ and deionized water. See Column 7, line 2 of Lou. There are no alternative materials listed throughout the Lou disclosure for the composition of the spacers 300.

Lou does not disclose a rigid dielectric spacer composed of a material selected from the *group consisting of SiCH, SiCOH, SiC and SiO₂*. Further, the method disclosed in Lou can not be modified to include one of applicants’ claimed spacer compositions. SiCOH and SiO₂ may not be substituted for SiN, since SiCOH and SiO₂ are etched by the HF incorporated within the chemical solution required for electroless deposition of

copper by Lou's method. One skilled in the art would not substitute SiC and SiCH for the SiN spaces disclosed in Lou, since SiC and SiCH are hydrophobic and therefore do not allow the water based chemical solution required of the electroless deposition process disclosed in Lou to penetrate the vias. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no motivation to make the proposed modification. In re Gordan, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Therefore, since Lou does not disclose one of applicants' claimed rigid dielectric spacer materials, Lou fails to disclose each and every element of applicants' claimed method, as recited in amended Claim 1.

Turning now to the §102 rejection of Claims 10-16 and 18, applicants submit that Lou fails to anticipate applicants' claimed invention, since Lou fail to disclose each and every aspect of the embodiment of applicants' method recited in amended Claim 10. Applicants' claimed method comprises the steps of providing a lower metal wiring level having first metal lines positioned within a lower low-k dielectric; depositing a mechanically rigid dielectric layer atop said lower metal wiring layer; forming at least one via through said mechanically rigid dielectric layer to a portion of said first metal lines; and forming an upper metal wiring level having second metal lines positioned within a upper low-k dielectric, said second metal lines being electrically connected to said first metal lines through said via, wherein said via comprises a metal having a coefficient of thermal expansion that substantially matches said mechanically rigid dielectric layer, *said mechanically rigid dielectric layer separating said upper metal wiring level from said lower metal wiring level*. More specifically, Lou fails to disclose a method that includes a mechanically dielectric rigid layer positioned between an upper metal wiring level and a lower metal wiring level, in which electrical connectivity

between the upper metal wiring level and the lower metal wiring level is provided through vias in the mechanically dielectric rigid layer.

Referring to Page 4 of the Office Action, it is the Examiner's position that the lower low-k dielectric (doped SiO₂) that covers the top of the first metal lines of the Lou interconnect meets the limitation of applicants' claimed mechanically rigid dielectric layer. Applicants respectfully disagree and submit that the dielectric layer to which the Examiner is referring does not separate the upper metal wiring level from the lower metal wiring level, as recited in amended Claim 10. Referring to FIG. 2i of the Lou disclosure, Lou discloses that the low k-dielectric layer 240 is the dielectric material surrounding the via 310 and the lower metal line 220 of the lower metal wiring level. The low-k dielectric layer disclosed in Lou is not a distinct mechanically dielectric rigid layer that separates a lower metal wiring level from an upper metal wiring level, wherein electrical communication between the upper metal wiring level and the lower metal wiring level is provided by vias through the mechanically rigid dielectric layer. Therefore, Lou fails to disclose each and every element of applicants' claimed method, as recited in amended Claim 10.

The forgoing remarks clearly demonstrate that the applied reference does not teach each and every aspect of the claimed invention as required by *King and Kloster Speedsteel; et. al.*, therefore the claims of the present application are not anticipated by the disclosure of Lou. Applicants respectfully submit that the instant §102 rejection has been obviated and withdrawal thereof is respectfully requested.

Turning to the rejection of Claims 6-9 and 17 under 35 U.S.C. §103(a), applicants submit that Lou fails to render applicants' claimed invention, as recited in Claims 6-9 and 17, unpatentable, under 35 U.S.C. §103(a), for the same reasons that Lou fails to

anticipate applicants' claimed invention, as recited in Claims 1-5, 10-16 and 18, under 35 U.S.C. §102(b). Claims 6-9 are dependent on amended Claim 1 and Claim 17 is dependent on amended Claim 10. If an independent claim is non-obvious under 35 U.S.C. §103(a), then any claim depending therefrom is non-obvious. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988). "To establish a prima facie case of obviousness of a claimed invention all the claimed limitations must be taught or suggested by the prior art". *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 44, 496 (CCPA 1970).

Applicants respectfully submit that the above remarks, concerning the deficiencies of Lou to anticipate applicants' claimed method, under 35 U.S.C. §102(b), apply equally well to the obviousness rejection of Claims 6-9 and 17, under 35 U.S.C. §103(a). To reiterate, Lou fails to render the embodiment of applicants' method recited in amended Claim 1, because Lou fails to teach or suggest a method which includes applicants' claimed rigid insulating spacers of a material selected from the group consisting of SiCH₃, SiCOH, SiC and SiO₂. Lou fails to render the embodiment of applicants' method recited in amended Claim 10, because Lou fails to teach or suggest a mechanically rigid layer that separates a lower metal wiring level from an upper metal wiring level, wherein electrical communication between the upper metal wiring level and the lower metal wiring level is provided by vias through the mechanically rigid dielectric layer.

The §103 rejection also fails because there is no motivation in Lou, which suggests modifying the methods disclosed therein to include applicants' claimed method, as recited in amended Claims 1 and 10. The rejection is thus improper since the prior art

does not suggest this drastic modification. The law requires that a prior art reference provide some teaching, suggestion, or motivation to make the modification obvious.

Here, there is no motivation provided in the disclosures of the applied prior art reference, or otherwise of record, which would lead one skilled in the art to modify the methods of the applied reference to provide applicants' claimed method. "The mere fact that the prior art may be modified in the manner suggested by the Examiner does not make the modification obvious unless the prior art suggested the desirability of the modification." *In re Fritch*, 972 F.2d, 1260,1266, 23 USPQ 1780,1783-84 (Fed. Cir. 1992).

Based on the above remarks, the §103 rejection of Claim 6-9 and 17 have been obviated; therefore reconsideration and withdrawal of the instant rejection are respectfully requested.

In summary, applicants respectfully submit that this application is in condition for allowance. Accordingly, applicants respectfully request that this application be allowed and a Notice of Allowance be issued. If the Examiner believes that a telephone conference with the applicants' representatives would be advantageous to the disposition of this case, the applicants request that the Examiner telephone the undersigned.

Respectfully submitted,



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